Working Paper

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Evaluation of Selected MANPRINT Issues for the Product Improvement Program of the OQ-290(V)1 Electronic Equipment Test Facility

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EVALUATION OF SELECTED MANPRINT ISSUES FOR THE PRODUCT IMPROVEMENT PROGRAM (PIP) OF THE OQ-290(V) ELECTRONIC EQUIPMENT TEST FACILITY (EETF)

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INTRODUCTION

In mid-1987 coordination was initiated between the Army Research Institute (ARI) Fort Hood Field Unit and the Communications Electronics Board (CEBD) regarding data collection and analysis on several MANPRINT issues to be addressed in the (recently completed) Product Improvement Program (PIP) Test for the AN/USM-410(V)2/OQ-290(V)1. Subsequent coordination in late 1987 between ARI and the CEBD led to agreement on specific issues for which ARI would perform data collection and/or analysis activities. Per agreement between the CEBD and ARI, Fort Hood Field Unit, data was collected and analyzed for several Product Improvement Program (PIP) issues. This report is designated a working paper and, for the most part, is still formatted as it was to meet the needs of the CEBD Test Officer. Specifically, each of the issues addressed is stated, followed by method of analysis, and findings.

DESCRIPTION OF SYSTEM

The Automatic Test Equipment (ATE) AN/MSM-105(V)1 (Figure 1) is used by Echelons Above Corps (EAC) and Intermediate General Support (IGS) as a general purpose computer controlled automatic test system. This system permits diagnostic and fault isolation capability for many Line Replaceable Units (LRUs) and Printed Circuit Boards (PCB) which are integral to operation of many sophisticated military electronic systems. This diagnostic and fault isolation capability is made possible by using tailored component-specific software called Test Program Sets (TPS). This system is composed of the Electronic Test Facility (ETF) OQ-290(V)1, Electronic Repair Facility (ERF) OA-8991, AN/MJQ-12A power plant, a M-931 5 ton tractor and a S-640/G storage shelter mounted on a 5-ton M-939 truck.

BACKGROUND

Earlier testing of the AN/USM-410(V) led to identifications of several deficiencies. Those deficiencies together with the anticipated technological obsolescence of several subsystems motivated the PIP Test noted above. In April 1985 an Operational and Organizational (O&O) plan was drafted in response to the identified need. Since the AN/USM-410(V)is expected to be used at least into the 1995-2000 time frame and the existing computers/peripherals and disk drive will not be commercially supportable past 1988, replacement components must be used to preserve this capability. The major purposes of this PIP Test were to assure that the replacement components are compatible with the considerable amount of TPS software already developed, that human factors concerns associated with these components are acceptable and that health hazards and system integrity will be maintained within acceptable limits.

ISSUE 2.4.1.2.3: EQUIPMENT PUBLICATION ADEQUACY AND READING GRADE LEVEL

Final validated draft revisions of equipment publications must be complete, understandable and usable by operators who are the maintainers. Revisions must be written within ± 1 of reading grade level (RGL) of the target audience. RGL for the operators is the 10th grade.

AUTOMATIC TEST EQUIPMENT (ATE)
AN/MSM-105(V)1

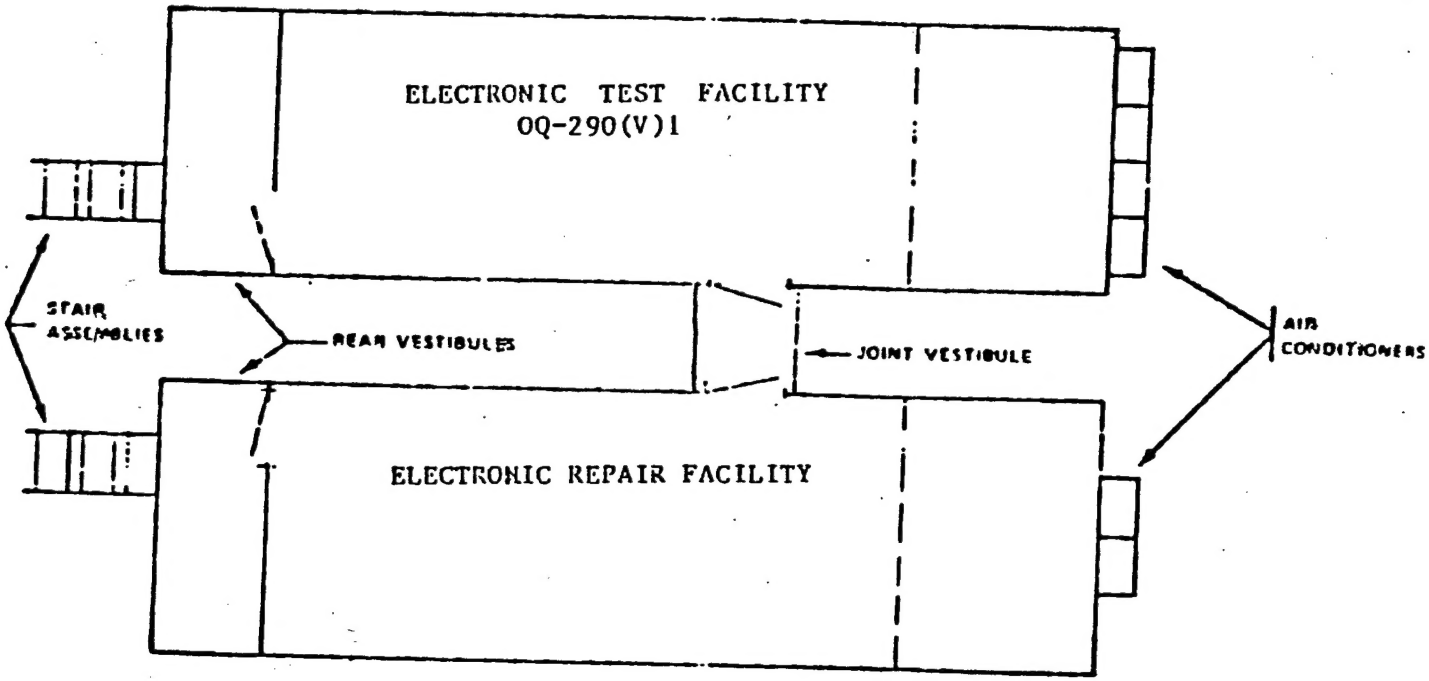

FIGURE 1

Operational Deployment Configuration

Method of Analysis[1]

Data addressing this issue were derived from three sources:

1) An ARI interview/questionnaire was developed to solicit judgments of Military Occupational Speciality (MOS) 39B operators and operators/maintainers (players) participating in the evaluation 9 May 88 through 27 May 88. Six trained data collectors (non MOS 39B) were also intervie to determine whether they heard any comments or saw any material during the test whi h addressed the suitability of equipment publications. The complete interview/questionnaire used in this evaluation is presented as an Appendix A to this document.

2) Comments from players obtained during the interview which address the completeness, understandability and usability of the equipment publications.

3) Reading Grade Level (RGL) Analyses were completed by preparing selected text samples from publications used to operate and maintain the OQ290(V)1 EETF for entry into a word processing system. RGL estimates were obtained for each sample using the Fleisch-Kincaid computational procedure.

Findings

In soliciting judgments about the equipment publications, primary attention focused on those publications used most often--the "10", "20" and "30" series. A frequency tabulation in Table 1-3 is shown for evaluations made for each of several criteria used to rate these three series of Technical Manuals (TMs).

Table 4 summarizes the verbal comments made addressing these criteria. As noted in an earlier planning document, there recommendations should be supplemented by student responses during MOS training and instructor comments.

It should be pointed out that inclusion of the comments in Table 4 does not necessarily imply concurrence on their value. When offered by player personnel, comments appeared to have merit and be worthy of consideration.

Table 5 summarizes the results of the RGL analyses. As the issue is stated, RGL should be between 9.0 and 11.0 for all samples. Since computation of RGL is done to assure that the text is not beyond the ability of the target audience, one might infer that the writer(s) of this issue really meant to assure that the level did not exceed 11.0. With this understanding, review of Table 3 indicates that the text is written to the ability of the MOS 39B target audience.

[1]Throughout the analyses reported in this document, frequency tables are presented, as appropriate. However, with only six operators/maintainers, use of frequency tabulations must be supplemented with other data sources to more adequately interpret findings, e.g., player comments and analyst judgments.

Table 1

Judgments Made by Six Players for the OQ-290(V)1 about the Adequacy of Equipment Publication TM 11-6625-2773-10

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
TM Organization	1	5			
TM Completeness	2	2	2		
TM Accuracy	2	3	1		
TM Clarity	6				
TM Indexing/ referencing	3	2	1		
TM Illustrations	5	1			
TM Field use durability	2	4			

Note. Tabled entries are frequencies

Table 2

Judgments Made by Six Players for the OQ-290(V)1 about the Adequacy of Equipment Publication TM 11-6625-2773-20

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
TM Organization	2	4			
TM Completeness	4	2			
TM Accuracy	2	4			
TM Clarity	5	1			
TM Indexing/ referencing	3	3			
TM Illustrations	4	2			
TM Field use durability	2	4			

Note. Tabled entries are frequencies

Table 3

Judgments Made by Five Players for the OQ-290(V)1 about the Adequacy of Equipment Publication TM 11-6625-2773-30

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
TM Organization	1	4			
TM Completeness	3	1	1		
TM Accuracy	2	3			
TM Clarity	4	1			
TM Indexing/ referencing	2	3			
TM Illustrations	3	1	1		
TM Field use durability	2	2	1		

Note 1. Tabled entries are frequencies
Note 2. One of the six players indicated he did not use the "30" Series manual and so could make no judgments.

Comments and recommendations made by players regarding the adequacy of equipment publications are presented immediately below:

Completeness and Accuracy

All publications

1. Wiring diagrams are not simple to use in locating wires creating a problem.

2. Typos/misprints/omissions do exist and were brought to players' attention during "refresher training" conducted just prior to the PIP Test (2 comments).

3. Appears to be a fragmentation of information, e.g., documentation has names of boards but not the slot numbers into which they are placed. This makes checkout when powering-up more difficult.

TM 11-6625-2773-10

As noted on the CHANGE X pages indicated, the following changes are recommended:

	Page	Recommended change
1.	2-219	"M. ... PRINTER switch settings 6, 7, 8 DOWN; all others UP."
2.	2-235	"...Proceed to the next paragraph (2-3A-8). Log IN under OP | if doing Authorize new users | preparation of Log OFF | system Log IN under username | disk Load back upcal tape on tape transport Type restorecal Tape back upcal tape off tape transport"
3.	2-253	Where "NONE" in message column appears write NONE | DISK Board / Combat Board / TSI Board / Tape | Replace
4.	2-272	1. Error message (Example only) ... Next text should read ERROR, NOBURST COMPLETE - Notify W3 A4A3 make sure switch is set to operate.
5.	2-273	Before keyboard sketch insert "if SCP CL1 shows up on screen you have a problem. Reboot the system back to the log on state"

	Page	Recommended change
6.	2-296	at bottom of page to right of diagram insert 3 tapes DGG MV8-11/SC PF PP MV/ADEY P/N B4042 968 S01TA AN/USM-410 P/N B40429 05/S01TA
7.	2-297	before 3 at top of page insert: P/N B4042967/S017A SCPOS after 3, insert 3A. Set to low density on line 6, should read ...(e.g., 7 11 86) press NEW LINE
8.	2-298	line 7, should read ...(e.g., 13 30) press NEW LINE just before line 8. insert "you can type HELP at this POINT
9.	2-299	line 3 under 14. should read: "DEVICE CODE [24]? LDU (disk drive) line 1 under 21, should read: "Type" + and press NEW LINE--open access to all users at this time.
10.	2-300	Parenthetical comment to 22. should read: "At this point it established who has access to write" Parenthetical comment to 25. should read: 33 minutes. When complete, you should have 786 on octal LED display" Parenthetical comment to 26. should read: "if you type 5, it will take 3 1/2 hours"
11.	2-300	under 26. NOTE should read "If this (pattern) surface analysis..."
12.	2-300	parenthetical comment for 28. should read: "memory mapping"
13.	2-303	line 1 of 42. should read: "press NEW LINE (wait a few minutes)"
14.	2-304	last line of 48. (display) should include a note to operator in manual: "make sure 1 is in brackets following "enter choice [ ]" last line in display of 49. should read: DATE (MM/DD/YY)?" line 1 of 50. gives specific example.
15.	2-305	add to end of line 1 of 51.: ...(e.g., 14 30) and press NEW LINE
16.	2-306	parenthetical comment to 65. should be added "you can type BYE while the computer is rewinding"

	Page	Recommended change
17.	2-308	parenthetical comment to 71. should read: "(model number is in decimal, not octal)" line 3 of 74 should read: "pause 1 minute"
18.	2-311	line 3 of display under 91. should read "DATE (MM/DD/YY)?"
19.	2-312	line 2 in NOTE under 97. should read "After a long wait VDT shows:"
20.	2-313	line 2 of 104. add parenthetical comment--should say: "how many blocks you are authorized" include 106a. "Create Directory called User A" on 107. add to line 1: "page 2-233" before paragraph on 107. line 2, paragraph should be 2-3A-11A.
21.	2-325	line H. should read "FILE STATUS (FS/AS)"
22.	2-346	parenthetical comment after line 3 of NOTE should be: "(LOW DENSITY)"
23.	2-347	line 1 of 5 should show. "...VDT will show in 35 to 40 minutes" line 2 of 6. should read: "Type: SELECT E60FP001 and press NEW LINE to check floating point unit."
24.	2-348	D.2 should indicate page number 2-360 as well as paragraph.
25.	2-350	add "13A. RUN > indicates MVS4SX is running approximately 20 minutes"
26.	2-352	add "7A. Set density to High"
27.	2-355	line 1 of 10 should read: "...and type letter O after this pass..."

TM 11-6625-2773-30

1. More information on how to read wiring diagram is needed.

2. In the "30-3 manual, pages 2-202, para 2-3A-11 Station Power Key Switch Removal and Installation, the top figure says to desolder/resolder; in fact, the wires referenced are held in place by screws. The bottom figure on this page does not show how to position the cams.

Clarity of Expression

All publications

Too many WARNINGS/CAUTIONS. With such frequent use, they tend to be ignored (2 comments)

TM 11-6625-2773-20

Sequencing of steps is sometimes left out--under branching.

TM 11-6625-2773-30

Need more explanation of wire connection lists.

Indexing and Referencing

All publications

1. When a problem occurs, instruction frequently says to refer to a manual but not where in the manual.

2. Sub-indexing of chapters, e.g., 2.4.5, is cumbersome to use. A sequential numbering system without interving decimal points would be preferable.

TM 11-6625-2773-10

Improved access to key operating procedures might be realized by inserting dividers. One Player made the following recommendations (it is understood that this Player's manual was used by all Players during the PIP Test):

Divider Label	After page
LOCATION & DESCRIPTION	1-2
GENERAL INFORMATION	1-42.38
OPERATING INSTRUCTIONS	1-70
PMCS	2-54.38
NORMAL OPERATING MODE & CL_1 COMMANDS	2-210
POWER UP & DOWN PROCEDURES	2-219
EMERGENCY POWER DOWN	2-248
ERROR MESSAGES	2-250
OPERATIONAL PROCEDURES	2-272
INSTALLING & REMOVING TAPES	2-290
PREPARATION OF SYSTEM DISK	2-292
DATA HANDLING	2-312
CL_1	2-316
SELF TEST	2-338
PRINTER PAPER LOADING	2-366
ABNORMAL SHUT DOWN	2-368
OPERATOR MAINTENANCE	2-374
ABBREVIATIONS	E-4
INDEX	F-8

Illustrations Clarity and Usefulness

TM 11-6625-2773-30

Would be better to have cutaway views of large areas so there is a better orientation of the part being observed.

Durability for Field Use

All publications

1. Plenty of space for use

2. Not in binders when come from distribution, operators must get their own.

TM 11-6625-2773-30

Staples come out of "30-1" manual easily--should be issued in hard binders.

Table 4

Results of Reading Grade Level (RGL) Analyses Performed for Indicated Text

Sample No.	Text Source	Text Description	Pages	No. Words in Text	RGL
1	TM 11-6625-2773-10	Location & Description of Major parts	1-42.5 to 1.42.11	554	7.73
2	TM 11-6625-2773-10	VDT and Keyboard A8	2-54.30 to 2-54.39	1651	5.81
3	TM 11-6625-2773-10	Operational Procedures: VTOCP	2-274 to 2-275	484	5.41
4	TM 11-6625-2773-10	Operational Procedures: UUT Test Procedures	2-279F to 2-285	655	4.15
5	TM 11-6625-2773-10	Data Handling	2-314 to 2-316	495	3.79
6	TM 11-6625-2773-10	Self Test	2-348, 2-350	366	4.69
7	TM 11-6625-2773-20	Fault Symptom List	2-98.3 to 2-98.7	1040	4.65
8	TM 11-6625-2773-20	Computer Control Group Troubleshooting	2-177.1 to 2-177.2	112	7.15

Table 4 (cont.)

Sample No.	Text Source	Text Description	Pages	No. Words in Text	RGL
9	TM 11-6625-2773-20	General Maintenance Using MV/8000C Control Station	2-232 2-232.1, 2-232.42, 2-232.47 to 2-232.51	671	6.33
10	TM 11-6625-2773-30-1	VDT System Cables Troubleshooting	2-86.20 to 2-86.21	166	6.98
11	TM 11-6625-2773-30-3	Tape Transport A3A1 Removal/Installation	2-173 to 2-175 2-178 to 2-180	575	6.76
12	TM 11-6625-2273-30-1	Location and Description of Major Parts: Control Station A3	1-26	160	7.87
13	TM 11-6625-2273-30-1	Location and Description of Major Parts: DC Station	1-28	204	9.38
14	TM 11-6625-2273-30-1	Location and Description of Major Parts: UUT Station	1-30	260	8.44
15	TM 11-6625-2273-30-1	Location and Description of Major Parts: PIU Station	1-35	83	5.25
16	TM 11-6625-2273-30-1	Location and Description of Major Parts: RF Station	1-36 to 1-38	366	10.38
17	TM 11-6625-2773-30-3	How to Use Maintenance Sections	2-98.1 to 2-98.4, 2-98.7 to 2-98.14	729	7.14
18	TM 11-6625-2773-30-3	How to Use the Multimeter	2-98.15 to 2-98.16	243	5.13
19	TM 11-6625-2773-30-4	Diodes A2A6CR1 thru A2A6CR15 Removal/ Installation	2-96, 2-99	166	7.76

Table 4 (cont.)

Sample No.	Text Source	Text Description	Pages	No. Words in Text	RGL
20	TM 11-6625-2773-30-4	Terminals A2A6E1 thru A2A6E17 Removal/ Installation	2-100, 2-103	128	7.87
21	TM 11-6625-2773-30-4	Relays A2A6K1 thru A2A6K15 Removal/ Installation	2-104, 2-107	129	5.39
22	TM 11-6625-2773-30-4	Resistors A2A6R1 thru A2A6R15 Removal/ Installation	2-108, 2-111	129	6.45
23	TM 11-6625-2773-30-4	Circuit Breakers A2A11CB1	2-119, 2-120	141	7.65
24	TM 11-6625-2773-35	Alinement Procedures	4-44 to 4-46	1112	9.29
25	TM 11-6625-2773-35	Operating Instructions/ Procedures	4-47, 4-48 4-50 to 4-53	708	7.17
26	TM 11-6625-2773-40	High Speed Trigger PCB (B4039437) Test and Repair	2-46 to 2-47	138	3.83
27	TM 11-6625-2773-10	Tape Transport A3A1	2-54.17 to 2-54.18	287	5.34
28	TM 11-6625-2773-20	Control Panel Power Supply A3A3PS1 and PS2 Replacement	2-290.13, 2-290.14	141	5.02
29	TM 11-6625-2773-20	Control Panel PCB A3A3A2 through A3A3A31 Replacement	2-290.15, 2-290.16	159	6.06

ISSUE 2.7.1.2.1: TEST PANEL AND VIDEO DISPLAY TERMINAL ADEQUACY

Operator's test panel and video display terminal must be capable of being adjusted so as to provide visual access for the operator from a single position.

Method of Analysis

An ARI interview/questionnaire was developed to solicit judgments of players who participated in the 9-27 May 88 PIP Test. The complete interview/questionnaire used in this evaluation is presented as an Appendix to this

document. In order to address this issue, test players were asked about the adequacy of the Video Display Terminal (VDT) on eight dimensions.

Findings

Table 5 summarizes the ratings test players made on each of the eight characteristics.

Table 5

Adequacy of the VDT Across Several Rating Dimensions

VDT Characteristic	Completely Adequate	Mostly Adequate	Borderline
Display brightness	6	0	0
Absence of glare	5	1	0
Absence of flicker	4	2	0
Letter discrimination	5	1	0
Viewing distance	5	1	0
Angle of view	4	2	0
Location of display	3	1	2
Adjustability (for visual access to test panel)	5	1	0

Note. No characteristic of the VDT received a less than Borderline adequacy rating. Table entries are the number of players making the ratings.

It is clear from review of Table 5 that the VDT is generally quite adequate. Two players recommended reducing the table size on which the VDT stands to give more working room.

ISSUE 2.7.1.2.2: CONTROLS/INDICATORS ADEQUACY

Controls and indicators shall be clearly labeled and visible to the user.

Method of Analysis

An ARI interview/questionnaire was developed to solicit judgments of players who participated in the 9-27 May 88 PIP Test. For this evaluation, this issue was addressed by asking players to rate the adequacy of: 1) Keyboard and Controls along 18 dimensions; 2) Combined Tape/Control Station Indicator Lights along 13 dimensions and 3) Combined Tape/Control Station controls along 18 dimensions. Some of these dimensions directly address clarity of labels and visibility; other dimensions addressed are correlated with and probably contribute to label clarity and visibility of Controls and Indicators.

Findings

Table 6 summarizes the number of players who indicated each adequacy rating for the dimensions used to evaluate the Keyboard and Controls of the

2VDT. Review of frequency data in this Table indicate that on the whole the Keyboard and Controls were quite adequate.

Table 6

Adequacy of Video Display Keyboard and Controls Across Several Rating Dimensions

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
a. Size	6	—	—	—	—
b. Shape	6	—	—	—	—
c. Spacing between controls	4	1	1	—	—
d. Resistance (too easy to turn or push, or too hard to turn or push)	6	—	—	—	—
e. Label correctness	6	1	—	—	—
f. Label visibility (size)	6	—	—	—	—
g. Label completeness	5	1	—	—	—
h. Understandable labels	6	—	—	—	—
i. Location of labels	6	—	—	—	—
j. Absence of unrelated or confusing markings	5	1	—	—	—
k. Visibility of controls	6	—	—	—	—
l. Angle of view	6	—	—	—	—
m. Location of critical controls	3	2	1	—	—
n. Reach distance of critical controls	5	1	—	—	—
o. Location of noncritical controls	5	—	1	—	—
p. Reach distance of noncritical controls	6	—	—	—	—

Note. Tabled values are numbers of players making the rating.

There were two recommendations by the players that merit consideration:

	Dimension	Recommendation
1.	Location of non-critical controls	Place a space bar on the number pad; with the new keyboard must use the space bar (2 comments)
2.	Spacing/Location of Keys	Some keys with inconsistent functions are too close together e.g., PROCEED, YES, NO. They should be separated and/or color coded to reduce incorrect use (2 comments)

Tables 7 and 8 show the number of players who indicated each adequacy rating for 13 dimensions used to evaluate the Combined Tape/Control Station indicator lights and 18 dimensions used to evaluate the Controls of the Combined Tape/Control Station.

Table 7.

Adequacy of Combined Tape/Control Station Indicator Lights Across Several Rating Dimensions

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
a. Brightness	6				
b. Absence of glare	6				
c. Absence of flicker	5	1			
d. Viewing distance	6				
e. Angle of view	5	1			
f. Understandable label	6				
g. Correct labels	6				
h. Label visibility (size)	4	2			
i. Label completeness	6				
j. Location of indicators	3	2	1		
k. Indicator lights inform you of what you need to know					
(1) in a timely manner	6				

Table 7 (cont.)

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
(2) with enough precision	6	___	___	___	___
(3) with relevant information	6	___	___	___	___

Note. Tabled values are numbers of players making the rating.

Table 8

Adequacy of Combined Tape/Control Station Controls Across Several Rating Dimensions

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
a. Size	6	___	___	___	___
b. Shape	6	___	___	___	___
c. Spacing between controls	6	___	___	___	___
d. Resistance (too easy to turn or push, or too hard to turn or push)	6	___	___	___	___
e. Correct labels	6	___	___	___	___
f. Label completeness	6	___	___	___	___
g. Understandable labels	6	___	___	___	___
h. Label visibility (size)	5	1	___	___	___
i. Location of labels	5	1	___	___	___
j. Absence of unrelated or confusing markings	6	___	___	___	___
k. Visibility of controls	5	1	___	___	___
l. Angle of view	4	2	___	___	___

Table 8 (cont.)

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
m. Location of critical controls	4	2	—	—	—
n. Reach distance of critical controls	6	—	—	—	—
o. Location of noncritical controls	6	—	—	—	—
p. Reach distance of noncritical controls	6	—	—	—	—

Note. Tabled values are numbers of players making the rating.

While ratings reported generally attest to clearly labeled and visible indicators and controls on the Combined Tape/Control Station, four types of comments related to the dimensions addressed in this issue were provided:

Dimension	Comment
1. Location of controls for tape drive	To see controls when loading/unloading tapes, door has to be open. When door is shut, controls are covered.
2. Location of controls for control station	The location of two switches on the computer are low and not visible from a standing position. Wrong one could be inadvertently pushed if operator does not kneel down.
3. Location of indicator lights on control station	Have to get down on hands and knees to see several lights on the computer face, e.g., STATUS indicator.
4. Control visibility	Luminescent controls would be desirable to make them visible during a power outage; auxiliary lights are not that bright.

A review of both ratings and comments suggests that this issue has been met satisfactorily. Weighing the comments, it seems that the operator's job may be made a bit easier if the basis for these comments were removed. To better evaluate the merit of the comments, an attempt should be made to determine whether any problems resulted during the PIP Test which can be directly attributed to concerns identified in these comments.

ISSUE 2.7.1.2.3: GROUP IDENTIFICATION AND FUNCTIONAL LABELING OF CONTROL GROUP

Control group design must provide for group identification and functional labeling.

Method of Analysis

For both the VDT Keyboard and Controls as well as the Combined Tape/Control Station players were asked to rate the adequacy of: 1) Functional grouping (controls with related functions are grouped together and 2) Control type (type of control is appropriate for type of function).

Findings

Ratings for the Combined Tape/Control Station indicated all players considered this equipment component completely adequate on this issue. For the VDT Keyboard and Controls, however, there were three types of comments which are related to this issue.

	Dimension	Recommendations
1.	Spacing/Location of Keys	Some keys with inconsistent functions are too close together, e.g., PROCEED, YES, NO. They should be separated and/or color coded to reduce incorrect use (2 comments)
2.	Key labels	Function keys F_1-F_8 are so labeled. If the template which indicates what they do is misplaced, deciding which key to press may be a problem. Consider giving these keys function-specific labels.
3.	Other	Need a terminal RESET key. Pushing SHIFT-ESP causes the disc system to crash--which is easy to do.

ISSUE 2.7.1.2.4: WEIGHT LABELING OF OPERATOR CONTROL GROUP COMPONENTS

All operator control group components must be properly labeled as one or two man lift.

Method of Analysis

The Test Control Officer and ARI representative inspected four parts of the control group components for appropriate labeling.

Findings

For each of the parts inspected the following observations are noted.

Part of Group Component	Observation
Disc Drive	Labeled as 130 lbs (Mechanical lift)
Tape Drive	Labeled as 150 lbs (Mechanical lift)
Computer Unit	Labeled as 105 lbs (Mechanical lift)
Test Operators' Control Panel	Any replacement is by individual "cards". No weight labeling or man-lift requirements is appropriate.

The criterion stated in this issue has been met.

ISSUE 2.7.1.2.5: OPERATION WITH MOPP GEAR/SOLDIER CHARACTERISTICS

Operator crew shall be capable of performing all critical tasks associated with operation of the upgraded control group while wearing Mission Oriented Protective Posture (MOPP) IV protective clothing.

Method of Analysis

Through communications with the Test Officer prior to the beginning of the PIP Test it was learned that the Directorate of Training and Doctrine would not be providing a list of critical tasks. It was further understood from talking with the Test Officer during the 25-27 May 88 data collection period that times to complete specific tasks were recorded while wearing/not wearing MOPP IV gear. Although these time data were not provided to the ARI representative, a simple t test for dependent observations could be computed using times to complete comparable "activities" with and without MOPP IV gear. Such a test would permit a statistical inference concerning the effect (or no effect) of use of MOPP IV protective clothes on operation of the EETF.

As noted in Appendix G of the Draft Test Design Plan, OQ-290(V)1 Product Improvement dated 11 Feb 88, data collection under this issue would also include MOS training scores, SQT scores, and ASVAB scores for MOS 39B PIP Test players and non-players. It should first be noted that these latter data specifically do not address the issue; however, information of this nature is of potential importance for the final test report to document sample representativeness. Specifically to what extent are the MOS 39B soldiers who participated in this PIP Test comparable to the population of MOS 39B soldiers in the Army. Data of this nature is relevant only to the extent that the potential for difference exist between players and non-players.

MOS Training Scores

Mr. Vahren Wald at Ft Gordon who is involved in MOS 39B training indicated that all tests during MOS training were hands-on and students were scored only PASS/FAIL. Since all 39B MOS holders must pass to be awarded the MOS, such data would not discriminate between test players/non-players. Consequently no MOS training score data are presented.

Skill Qualification Test (SQT) Scores

Discussion with the Test Officer indicated that test players had just completed their MOS 39B training and had not yet taken an SQT; consequently it was not possible to compare PIP Test players non-PIP Test players on this measure.

Armed Services Vocational Aptitude Battery (ASVAB) Scores

Through coordination with the Defense Manpower Data Center in San Diego, CA, the AFQT, ASVAB Scaled Score Composites and raw Subtest scores were obtained for all MOS 39B.

Demographic Characteristics of PIP Test and Non-PIP Test Soldiers

Using data obtained from the Defense Manpower Data Center, information on MOS 39B soldiers was obtained for: 1) Civilian education; 2) Rank, 3) Age, and 4) Ethnicity. Frequency of cases in each category for PIP Test and non-PIP Test soldiers is presented in tabular form.

Findings

Operation with MOPP Gear

There were few problems apparent in operating the EETF with MOPP IV protective clothing. Two players indicated some difficulty in operating the keyboard because the keys were too close to be pushed individually when wearing the MOPP IV thick rubber gloves. Data collectors indicated that this problem is generally remedied by pressing individual keys with a pen or pencil. No comments were made about fogging up of facemask lens or build up of body heat. The absence of problems may have been a consequence of the relatively short time MOPP IV gear were required to be worn continuously.

Soldiers Characteristics

Means and standard deviations for AFQT and ASVAB Scaled Score Composites are presented together with *t* tests of statistical differences between PIP Test and non-PIP Test soldiers in Table 9. Without exception the means for PIP Test soldiers are larger in absolute value for all tabled entries, however, only in one case were those differences statistically significant.

Means and standard deviations for the seven common Subtests (common to ASVAB forms 5-14) are presented together with *t* tests of statistical differences between PIP Test and non-PIP Test soldiers in Table 10. As for the AFQT and ASVAB Scaled Score Composites, most of the Subtest differences show scores favoring the PIP Test MOS 39B soldiers, in no case are those differences statistically significant. Taken together, only one difference found tabled in Tables 9 and 10 is statistically significant. With 18 comparisons, that difference could occur by chance about 5% of the time. Since there was no reason to expect any of these differences to differ significantly, it is reasonable to conclude there is no important difference between PIP Test and non-PIP Test MOS 39B soldiers an ASVAB performance.

Table 9

AFQT and ASVAB Aptitude Area Composites (Scaled Scores) for PIP Test and Non-PIP Test MOS 39B Soldiers

Scaled Score	PIP Test n	PIP Test Mean	PIP Test SD	Non-PIP Test n	Non-PIP Test Mean	Non-PIP Test SD
Armed Forces Qualification Test (AFQT)	6	75.17	18.65	221	65.54	21.78
			t=1.07, df=225, p>.05			
Combat (CO)	6	117.83	4.67	221	111.07	15.44
			t=3.12, df=5, p<.05			
Field Artillery (FA)	6	116.67	9.24	221	112.32	14.96
			t=.71, df=225, p>.05			
Motor Maintenance (MM)	6	118.17	8.93	221	114.99	13.00
			t=.59, df=225, p>.05			
General Mechanical (GM)	6	119.67	10.13	221	115.46	13.13
			t=.78, df=225, p>.05			
Clerical (CL)	6	112.83	9.70	221	109.06	13.17
			t=.69, df=225, p>.05			
General Technical (GT)	6	116.50	8.24	221	110.83	12.18
			t=1.13, df=225, p>.05			
Electronics (EL)	6	116.83	9.97	221	115.13	12.11
			t=.34, df=225, p>.05			
Surveillance/ Communications(SC)	6	116.67	8.78	221	110.58	13.55
			t=1.09, df=225, p>.05			
Skilled Technical (ST)	6	116.83	8.70	221	113.20	11.97
			t=.74, df=225, p>.05			
Operators/ Food (OF)	6	115.67	6.09	221	111.78	13.71
			t=1.46, df=5, p>.05			

Note 1. All tests are two-tailed. Where variances of PIP Test and non-PIP Test samples do not differ significantly, the t statistic was computed by:

$$t=(\bar{x}_1-\bar{x}_2)\Big/\left[\sqrt{\frac{1}{n_1}\frac{1}{n_2}}\sqrt{\frac{(n_1-1)s_1^2+(n_2-1)s_2^2}{n_1+n_2-2}}\right],\ df=n_1+n_2-2$$

Note 3. For cases where variances of PIP Test and non-PIP Test samples do differ significantly, the t statistic was computed by:

$$t=(x_1-x_2)\Big/\sqrt{\frac{s_1^2}{n_1}+\frac{s_2^2}{n_2}}$$

df is the smaller of n_1-1 and n_2-1

Table 10

Selected ASVAB Subtest Scores (Percents) for PIP Test and Non-PIP Test MOS 39B Soldiers

Subtest	PIP Test n	PIP Test Mean	PIP Test SD	Non-PIP Test n	Non-PIP Test Mean	Non-PIP Test SD
General Science (GS)	6	78.17	14.54	221	76.27	16.83
			t=.27, df=225, p>.05			
Arithmetic Reasoning (AR)	6	84.17	9.41	221	77.92	16.41
			t=.93, df=225, p>.05			
Word Knowledge (WK)	6	89.21	12.49	221	80.87	16.65
			t=1.22, df=225, p>.05			
Numerical Operations (NO)	6	81.67	11.55	221	77.50	16.89
			t=.60, df=225, p>.05			
Mathematics Knowledge (MK)	6	69.67	17.21	221	70.05	18.98
			t=.05, df=225, p>.05			
Mechanical Comprehension (MC)	6	72.17	11.29	221	69.67	18.00
			t=.34, df=225, p>.05			
Electronics Information (EI)	6	84.17	13.57	221	75.62	13.95
			t=1.48, df=225, p>.05			

Note 1. Subtests selected for analysis were those which appeared in each ASVAB version, 5-14. Because Subtests in versions 5-7 and 8-14 are based generally on different numbers of items, all raw scores were converted to percentages prior to analysis.

Note 2. All tests are two-tailed.

Note 3. The t statistic was completed as shown in note 2 to Table 9

Tables 11, 12 and 14, respectively, show the tabled frequency of soldiers in each category for civilian education, rank and ethnicity. Data presented in these tables is provided only for descriptive comparison. Review of Tables 11, 12 and 14 generally show that those categories of non-PIP Test soldiers containing the largest number are those categories most frequented by PIP Test soldiers.

Table 11

Number of PIP Test and Non-PIP Test MOS 39B Soldiers in Each Category of Education

Education	PIP Test	Non PIP Test
1-7 yr Elementary		1
2 yrs High School		3
3-4 yrs High School (No diploma)		5
High School Grad	5	179
1 yr college		15
2 yrs college		10
3-4 yrs college, no diploma	1	2
College grad		6
n	6	221

Table 12

Number of PIP Test and Non-PIP Test MOS 39B Soldiers in Each Rank

Rank	PIP Test	Non-PIP Test
E-1		16
E-2		39
E-3	2	44
E-4		36
E-5	3	54
E-6	1	32
	6	221

Table 13

Means and Standard Deviations of PIP Test and Non-PIP Test Soldiers by Age

PIP Test			Non-PIP Test		
n	Mean	SD	n	Mean	SD
6	25.00	5.93	221	24.16	4.33

$t=.46$, $df=225$, $p>.05$

Table 14

Number of PIP Test and Non-PIP Test MOS 39B Soldiers in Each Racial/Ethnic Category

Race/Ethnicity	PIP Test	Non-PIP Test
1. White	5	157
2. Black	1	46
3. Hispanic		12
4. American Indian/Alaskan		2
5. Asian/Pacific Islander		2
6. Other		2
n	6	221

Results summarized in Table 13 indicate no significant differences in age of PIP Test and Non-PIP Test MOS 39B.

ISSUE 2.7.1.2.7: STEADY STATE NOISE IN TEST FACILITY

Steady-state noise within the OQ290(V)1 cannot exceed 65db(A).

Method of Analysis

It became apparent while in the EETF shelter that there were noise variations depending on the location. Consequently a Type 1565-B Sound level meter manufactured by General Radio in MA was used to take db(A) measurements at about six equally spaced locations from the front of the shelter (where the air conditioning unit is mounted) to the rear.

Findings

Table 15 shows the steady state noise level at each of six locations in the EETF shelter while operating in "full power".

Table 15

Steady State Noise (db(A)) Levels Recorded at Six Locations in the EETF Shelter

Location	db(A)
1. At front of shelter in front of air-conditioning unit	70
2. Below 9 inch raised platform just to right of shelter entrance	67
3. In front of VDT	66
4. In front of line printer while it was in operation	81

Table 15 cont.

Location	db(A)
5. In front of Control Station	73
6. Far rear of EETF shelter	69

Based on review of tabled data it is clear that the inside of the EETF shelter does not satisfy the criterion set forth in the issue statement. In review of MIL-STD-1474B(MI), page 16, it appears that the "Steady-state Noise category--System Requirement" used in establishing the 65db(A) criterion was the belief that "frequent telephone or radio use or frequent direct communication at distances up to 1.5m (5ft) (is) required". For this steady state noise category, Table 2 (page 17 of MIL-STD-1474B(MI) indicates a noise limit of 65 db(A). If reevaluation of the category were to specify "occasional telephone or radio use...", the acceptable noise limit would be 75 db(A). In this case, only when the printer was operating would the noise limit be exceeded. During interview with the PIP Test players, other comments about the printer, when combined with its noisiness, may warrant consideration of replacing it. The printer was described as requiring thermal paper which is expensive and difficult to obtain. Further, there is a tendency for the printer to jam when paper is torn off.

ISSUE 2.7.2.2: HEALTH HAZARDS AND SYSTEM SAFETY

System must be free of all uncontrollable safety or health hazards that would cause harm to either operating or maintenance personnel.

Method of Analysis

In planning for gathering data addressing this issue, two sources were identified: 1) Test Incident Reports (TIRs); and 2) response of PIP Test players to an ARI interview questionnaire. No TIRs addressing this issue were forwarded to the ARI representative, consequently all data supporting this issue came as responses to the ARI interview. In order to provide a structure to the data collection efforts, eight areas were identified as representing categories of potential health hazards or which might otherwise impinge on personnel safety. For each area, PIP Test players were asked in independent evaluation: 1) Had they experienced or nearly experienced such an event during the PIP Test ; 2) how likely they believed each event would occur; and 3) how severe each event would be to their health or other aspects of personnel safety (system safety). In order to lend structure to the analyses and facilitate recommendations, categories of response to the likelihood of the event and the severity of such an event were selected from categories used in a document prepared by the U.S. Army Test and Evaluation Command designed to facilitate decision making[2]. For each of these potential problem causing

[2] "Classification of Deficiencies and Shortcomings", Report No. TOP-1-1-012, 1 April 1979, U.S. Army Test and Evaluation Command, Aberdeen Proving Ground, MD

areas, frequency of player responses are cross-classified by categories of hazard frequency and severity used in Figure 1 of the document referenced in foothote 2. One such table is prepared for each potential problem area where the focus is on health hazards; a comparable table for each potential problem area is also presented where the focus is system safety. Since there is no reason to consider any players' opinions as more valid than any other, the cell in each of these tables which has the largest frequency will be used largely as a basis for concluding whether the particular potential problem is: 1) a deficiency; 2) a shortcoming; 3) an area where there is a suggested improvement; 4) an area where there may be a suggested improvement or be acceptable; or 5) an acceptable condition. It is important to note from the referenced document (footnote 2, P-3, para 3b) that "in analysis of test results great care must be taken to insure proper classification of test incidents as a deficiency or a shortcoming. The use of judgment, both technical and military is necessary together with the use of regulating criteria in the analysis of test incidents before classifying them." For purpose of this analysis, "test incident" refers to soldier judgments. In discussion of conclusions reached from such an analytic approach, actually experienced or nearly experienced incidents reported will also be noted. To the extent possible, findings from such an analysis for each area of potential concern will be discussed with suggestions for remediation. Nevertheless, since the ARI representative does not possess a complete technical knowledge of the EETF, use of results obtained must be subjected to technical and military judgment before any area of concern is definitively classified. The proponent for the system in conjunction with the responsible military evaluation component should also use the data presented herein together with other aspects of the test, consider the importance of the system to mission accomplishment, the cost of system development and anticipated costs that may result from injury to soldiers over the life cycle of the system in making a final judgment about whether a "deficiency" can/should be remedied.

Findings

As noted above, the basic data for this section are represented in cross-classification tables (see Tables 16-23).

Table 16 indicates that all players estimated the probability of electrical shock as REMOTE but that the hazard severity could be CATASTROPHIC. According to the model for analysis used (see footnote 2), electric shock in the EETF operation is a deficiency[3]. No injury due to electric shock was experienced during the month long test, however, five of the six players acknowledged independently that electric shock is a potential hazard. One player indicated he nearly experienced electric shock a couple of times when he arced his screw-driver. Perhaps soldiers operating/maintaining the EETF could be issued non-metallic tools and be required to wear shoes which prevent them from being grounded. It is not clear that additional training would lead

[3]According to AR 310-25 (Appendix A) a deficiency is "a defect or malfunction discovered during the life cycle of an equipment that constitutes a safety hazard to personnel or that will result in serious damage to the equipment if operations is continued..."

soldiers to be more careful. As noted in discussion of an earlier issue soldiers generally lamented that the TMs were overly replete with WARNING and CAUTION statements--so much so that they tended to be ignored.

Table 17 indicates that using the model for evaluation cited in footnote 2, five of six PIP Test players' responses indicated that burns received by operators/maintainers could be classified as either a SHORTCOMING[4] or being subject to SUGGESTED IMPROVEMENT[5]. Although two PIP Test players reported nearly experiencing burns, considering the AR definitions cited in footnotes 4 and 5 below and the conclusions presented in this model document for this analysis (cited in footnote 2) it would appear that the potential health hazard due to BURNS is a serious but not urgent concern. Based on conversations with experts who have worked with electronic equipment for many years, apparently the seriousness of Radio Frequency (RF) burns to soldier health is still unclear. The evidence is still being compiled and the jury is still out. At this time with the importance of MOS 39B to detecting and maintaining many sophisticated systems on the modern Army battlefield, when soldiers experience an RF burn (or any other), prompt medical attention should be given--for immediate symptom relief and to increase the state of knowledge. In this spirit, findings based on the reported comments of PIP Test players, it would be recommended that the Army assure that each EETF facility be equipped with the best modern methodology for treating burns and if warranted, that soldiers receive training on how to apply these specialized treatments.

[4]According to AR 310-25 (Appendix A) a SHORTCOMING is "an imperfection or malfunction occurring during the life cycle of equipment, which should be reported and which must be corrected to increase efficiency and to render the equipment completely serviceable. It will not cause an immediate breakdown, jeopardize safe operation, or materially reduce the usability of the material or/and product. If occurring during test phases, the shortcoming should be corrected if it can be done without unduly complicating the item or inducing another undesirable characteristic such as increased cost, weight, etc." Using this AR definition the authors of the model document cited in footnote 2 indicate (p.4, para 4b) "the developer should correct each reported shortcoming if it can be done without introducing another undesirable characteristic. In many instances the developer may determine that correction is impracticable."

[5]According to AR 310-25 (Appendix A) " a SUGGESTED IMPROVEMENT is defined as "an increase in quality or performance which is desirable but not imperative." The authors of the model document (footnote 2) go on to say "the developer is under no obligation to implement suggested improvements" (page 4, para 5b).

Table 16

Estimated Probability and Potential Severity of an Injury Resulting from an Electrical Shock to a Soldier while Operating/Maintaining the OQ-290(V)1 Electronic Equipment Test Facility.

	HAZARD SEVERITY			
	CATASTROPHIC May cause death	CRITICAL May cause severe injury or illness	MARGINAL May cause minor injury or illness	NEGLIGIBLE Will not result in injury or illness
FREQUENT likely to occur frequently	DEFICIENCY	DEFICIENCY	DEFICIENCY	SHORTCOMINGS
REASONABLY PROBABLE may occur several times during life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
OCCASIONAL likely to occur sometime in the life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
REMOTE unlikely but possible	6 DEFICIENCY	DEFICIENCY	SUGGESTED IMPROVEMENT	SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPROBABLE so unlikely it can be assumed occurrence may not be experienced	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPOSSIBLE Physically impossible to occur	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

Table 17

Estimated Probability and Potential Severity of an Injury Resulting from Burns to a Soldier while Operating/Maintaining the OQ-290(V)1 Electronic Equipment Test Facility.

	HAZARD SEVERITY			
	CATASTROPHIC May cause death	CRITICAL May cause severe injury or illness	MARGINAL May cause minor injury or illness	NEGLIGIBLE Will not result in injury or illness
FREQUENT likely to occur frequently	DEFICIENCY	DEFICIENCY	DEFICIENCY	SHORTCOMINGS
REASONABLY PROBABLE may occur several times during life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
OCCASIONAL will occur several times	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
REMOTE unlikely but possible	1 DEFICIENCY	2 SHORTCOMINGS	2 SUGGESTED IMPROVEMENT	SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPROBABLE so unlikely it can be assumed occurrence may not be experienced	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE	1 SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPOSSIBLE Physically impossible to occur	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

Using the model for evaluation cited in footnote 2, five of the six responses noted in Table 18 indicate that cuts and abrasions do not represent a serious health hazard although they were experienced or nearly experienced by three of the six players. Assuring that first-aid supplies are always available at the EETF seems a sufficient recommendation for this area of concern.

Using the model for evaluations cited in footnote 2, all responses in Table 19 indicate that any hazard due to extreme brightness is extremely improbable and will not result in injury or illness. There were no cases of extreme brightness being experienced or nearly experienced during the PIP Test. No recommendations for modification are warranted for changing EETF brightness.

Using the model for evaluation cited in footnote 2, five of the six responses noted in Table 20 indicate that any hazard due to extreme loudness was REMOTE and at worst would cause minor injury or illness. In only one case did a player believe extreme loudness would be a hazard which was OCCASIONAL in probability. When players were asked about extreme loudness as a hazard, while ratings as to probability and severity were not serious, it is clear that some soldiers will be more sensitive to sound than others. One player indicated need for hearing protectors. According to Tables 1 and 2 in MIL-STD-1474B(MI), hearing protection is required when dB(A) exceeds 85 dB(A); Table 1 TB MED 251, indicates that for hearing conservation purposes the recommended sound level exposure should not exceed a maximum of 85dB(A) during an 8 hour per day exposure. None of the physical steady-state noise measurements taken during this PIP Test exceeded 85dB(A). As noted, while one player did recommend use of hearing protectors, it would appear that the mission requirement for frequent telephone or radio use (as implied by the criterion set in issue 2.7.1.2.7) would preclude use of hearing protection. The constant hum of air-conditioners and/or forced air from the ducts may be an annoyance and over time cause some fatigue, but there is no indication that loss of hearing will result.

Table 18

Estimated Probability and Potential Severity of an Injury Resulting from Cuts or Abrasions to a Soldier while Operating/Maintaining the OQ-290(V)1 Electronic Equipment Test Facility.

	HAZARD SEVERITY			
	CATASTROPHIC May cause death	CRITICAL May cause severe injury or illness	MARGINAL May cause minor injury or illness	NEGLIGIBLE Will not result in injury or illness
FREQUENT likely to occur frequently	DEFICIENCY	DEFICIENCY	DEFICIENCY	SHORTCOMINGS
REASONABLY PROBABLE may occur several times during life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
OCCASIONAL likely to occur sometime in the life of an item	DEFICIENCY	DEFICIENCY	1 SHORTCOMINGS	SUGGESTED IMPROVEMENT
REMOTE unlikely but possible	DEFICIENCY	SHORTCOMINGS	1 SUGGESTED IMPROVEMENT	SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPROBABLE so unlikely it can be assumed occurrence may not be experienced	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE	3 SUGGESTED IMPROVEMENT OR ACCEPTABLE	1 SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPOSSIBLE Physically impossible to occur	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

Table 19

Estimated Probability and Potential Severity of an Injury Resulting from Extreme Brightness to a Soldier while Operating/Maintaining the OQ-290(V)1 Electronic Equipment Test Facility.

	HAZARD SEVERITY			
	CATASTROPHIC May cause death	CRITICAL May cause severe injury or illness	MARGINAL May cause minor injury or illness	NEGLIGIBLE Will not result in injury or illness
FREQUENT likely to occur frequently	DEFICIENCY	DEFICIENCY	DEFICIENCY	SHORTCOMINGS
REASONABLY PROBABLE may occur several times during life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
OCCASIONAL likely to occur sometime in the life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
REMOTE unlikely but possible	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT	SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPROBABLE so unlikely it can be assumed occurrence may not be experienced	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPOSSIBLE Physically impossible to occur	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

3

3

Table 20

Estimated Probability and Potential Severity of an Injury Resulting from Extreme Loudness to a Soldier while Operating/Maintaining the OQ-290(V)1 Electronic Equipment Test Facility.

	HAZARD SEVERITY			
	CATASTROPHIC May cause death	CRITICAL May cause severe injury or illness	MARGINAL May cause minor injury or illness	NEGLIGIBLE Will not result in injury or illness
FREQUENT likely to occur frequently	DEFICIENCY	DEFICIENCY	DEFICIENCY	SHORTCOMINGS
REASONABLY PROBABLE may occur several times during life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
OCCASIONAL will occur several times	DEFICIENCY	DEFICIENCY	1 SHORTCOMINGS	SUGGESTED IMPROVEMENT
REMOTE unlikely but possible	DEFICIENCY	SHORTCOMINGS	1 SUGGESTED IMPROVEMENT	1 SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPROBABLE so unlikely it can be assumed occurrence may not be experienced	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE	1 SUGGESTED IMPROVEMENT OR ACCEPTABLE	2 SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPOSSIBLE Physically impossible to occur	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

Table 21 indicates considerable player variability of response, especially concerning the severity of noxious fumes could have to a soldier operating/maintaining the EETF. Even with this variability in severity ratings, ratings by five of the six players would suggest that noxious fumes or a health hazard are not a serious concern. Only one player identified a possible source of noxious fumes in the EETF--burn-out of the conformal coding on boards. With such variability in the severity ratings, it would be desirable that sources of noxious fumes be identified by "experts" and then potential severity assessed.

Using the model for evaluation cited in footnote 2, four of the six players' responses in Table 22 indicate that "falls" as a health hazard warrants a SUGGESTED IMPROVEMENT; response for two players as well as data collectors suggest that danger from falls represents a DEFICIENCY. One player did experience a fall during the PIP Test and three others nearly experienced a fall. In three of those four cases, the falls as a health hazard were associated with entering and leaving the EETF. Falls as a health hazard would be greatly reduced if: 1) the ledge which must be stepped-over to get into and out of the EETF were eliminated; 2) the ladder had a railing with non-slip surfaces installed; and 3) an exterior light was installed for night in/out egress. It would also be desirable to add one riser to the ladder and thereby reduce the difference in height between steps. MIL-STD-1472B, Figure 29, p. 131 (December 1974) indicates that riser height should be a maximum of 12 inches, but 9 inches is recommended. Measurement of riser height between the ground and the first step was 7 inches (the minimum riser height recommended in the referenced MIL-STD). Riser heights from first to second and second to third step was 11 3/4 inches, the height between the third step and entry into the EETF was 12 inches. While in no case did riser height exceed the maximum recommended by the MIL-STD (12 inches), they generally exceeded the "RECOMMENDED" height (9 inches). The open-grating steel materiel used in construction of the current ladder is quite adequate.

One further potential "fall" health hazard was identified. It was noted that during movement of the EETF, it is necessary for someone to get on top of the trailer van--a position from which someone could fall. Consideration should be given to installing a hand-railing with non-slip surfaces along the perimeter of the EETF trailer van roof.

Using the model for analysis referenced in footnote 2, Table 23 indicates that laser radiation does not pose a health hazard in the EETF. No recommendations are warranted.

Two additional factors related to soldier health, but not specifically addressed in the interview, arose during discussion with data collectors. Specifically, it would desirable if the EETF contained chairs with sufficient back support for extended use. Also recommended was the repositioning of the thermostat in the shelter so that operators/maintainers will not bang into it.

Table 21

Estimated Probability and Potential Severity of an Injury Resulting from Noxious Fumes to a Soldier while Operating/Maintaining the OQ-290(V)1 Electronic Equipment Test Facility.

	HAZARD SEVERITY			
	CATASTROPHIC May cause death	CRITICAL May cause severe injury or illness	MARGINAL May cause minor injury or illness	NEGLIGIBLE Will not result in injury or illness
FREQUENT likely to occur frequently	DEFICIENCY	DEFICIENCY	DEFICIENCY	SHORTCOMINGS
REASONABLY PROBABLE may occur several times during life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
OCCASIONAL likely to occur sometime in the life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
REMOTE unlikely but possible	DEFICIENCY	1 SHORTCOMINGS	SUGGESTED IMPROVEMENT	SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPROBABLE so unlikely it can be assumed occurrence may not be experienced	1 SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE	1 SUGGESTED IMPROVEMENT OR ACCEPTABLE	2 SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPOSSIBLE Physically impossible to occur	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	1 ACCEPTABLE

Table 22

Estimated Probability and Potential Severity of an Injury Resulting from Falls to a Soldier while Operating/Maintaining the OQ-290(V)1 Electronic Equipment Test Facility.

	HAZARD SEVERITY			
	CATASTROPHIC May cause death	CRITICAL May cause severe injury or illness	MARGINAL May cause minor injury or illness	NEGLIGIBLE Will not result in injury or illness
FREQUENT likely to occur frequently	DEFICIENCY	DEFICIENCY	DEFICIENCY	SHORTCOMINGS
REASONABLY PROBABLE may occur several times during life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
OCCASIONAL likely to occur sometime in the life of an item	1 DEFICIENCY	1 DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
REMOTE unlikely but possible	DEFICIENCY	SHORTCOMINGS	2 SUGGESTED IMPROVEMENT	SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPROBABLE so unlikely it can be assumed occurrence may not be experienced	SUGGESTED IMPROVEMENT OR ACCEPTABLE	1 SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE	1 SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPOSSIBLE Physically impossible to occur	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

Table 23

Estimated Probability and Potential Severity of an Injury Resulting from Laser Radiation to a Soldier while Operating/Maintaining the OQ-290(V)1 Electronic Equipment Test Facility.

	HAZARD SEVERITY			
	CATASTROPHIC May cause death	CRITICAL May cause severe injury or illness	MARGINAL May cause minor injury or illness	NEGLIGIBLE Will not result in injury or illness
FREQUENT likely to occur frequently	DEFICIENCY	DEFICIENCY	DEFICIENCY	SHORTCOMINGS
REASONABLY PROBABLE may occur several times during life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
OCCASIONAL likely to occur sometime in the life of an item	DEFICIENCY	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT
REMOTE unlikely but possible	DEFICIENCY	SHORTCOMINGS	SUGGESTED IMPROVEMENT	SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPROBABLE so unlikely it can be assumed occurrence may not be experienced	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE	SUGGESTED IMPROVEMENT OR ACCEPTABLE
IMPOSSIBLE Physically impossible to occur	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE	ACCEPTABLE

Several potential concerns about system reliability arose. For one, there were questions regarding the effects of lightning on system safety. The data collectors indicated that an electrical storm had occurred during the PIP Test and the "power protection unit" caused the system to shut down. Adequacy of the reliability of this "unit" should be assured.

Also having a potential effect on system reliability is the extent to which sensitive electronic equipment in the shelter is adequately cushioned. This concern was raised by the data collectors specifically within the context of the conditions under which the PIP Test was conducted. During moves made in the PIP Test the roads were smooth. The data collectors proposed the scenario of having to travel over rough roads at a doctrinally specified 5 mph in a war-time environment. Would soldiers exceed 5 mph? Would equipment be damaged if they did? It would be prudent to consider mounting equipment in the shelter on cushioned supports to provide an added measure of protection for the EETF under non-peace time conditions.

ISSUE 2.7.2.6: COMPUTER PROMPTS ADEQUACY

Computer prompts shall be complete, understandable and usable by operators and maintainers.

All operator control group functions (e.g., push buttons, dials, keys, etc.) will correspond with current TPS instructions.

Method of Analysis

Data collected to address this issue came from two sources: 1) Comments made by PIP Test players during the interview by the ARI representative; and 2) Test Incident Reports (TIR) prepared by data collectors under control of the CE Board during the PIP Test. TIR's were used to provide documentation of cases where an UUT was tested under both the "old" and updated (PIP) system with different diagnostic results. While such discrepancies cannot be conclusively linked to different operating systems or Test Program Set (TPS) software; those discrepancies should be investigated. Since a system evaluation of this type cannot be expected to identify all "glitches" in the current operating system or TPS software, it would be prudent to be sensitive to other problems that may appear in the future. Since it is unlikely that both the original and PIP version likely to used in the future on the same Unit Under Test (UUT), the major diagnostic information which can serve this function is the collating of diagnostic conclusions reached with observations made by intermediate or depot maintainers of UUT returned for repair.

Findings

Four comments were obtained during interviews by the ARI representative which suggest the need to verify (and correct where judged necessary) the operational compatability between the new operating system used to drive the Combined Tape/Control Station and the updated Video Display Terminal (VDT)--operational compatabilities which existed with the "old" configuration.

Comments (PIP Test Players)

1. Sometimes when a message is first displayed on the VDT screen, it is incomplete; however, scrolling the screen forward and then back does lead to the complete message.

ARI Comment

By itself this comment suggests only a rather minor inconvenience to operators and maintainers; however, such a comment should be viewed as a symptom that a significant problem may exist. This comment may indicate the "tip of an iceberg" of a problem with either the operating system and/or TPS software.

2. The character set on the updated VDT does not appear to be the same as on the "old". Specifically, the control codes for some characters seem to be different. Such differences may result in a need for TPS software and/or operating system change.

ARI Comment

It would probably be more efficient to remedy this discrepancy by revising the operating system now used rather than attempting to assure that all TPS software sets are compatible with the current operating system.

3. The cursor control keys operate only when the system is not executing a test. Compared to the original system, the PIP system does not allow the operator to scroll down during execution of the program--he must wait for a "hard" PAUSE. This creates a problem in trying to troubleshoot. In the "old" system, the program could be put in PAUSE to allow as much scrolling back and forth as desired.

4. The output of any TPS and diagnostic tape operating system (DTOS) parts location on boards will not printout (as with the "old" system) until a complete analysis is finished. For some pieces of equipment, this output is needed to know where to do probes. This is particularily a problem for Tactical Communications Control (TCC) 39 boards, system boards and on the TACFIRE boards.

ARI Comment

This difference may well be due to the difference in operating systems used in the "old" and PIP Control Station.

Table 24 documents events reported in TIR's which appear to reflect incidents where the TPS software and/or operating systems do not produce the same conclusions as those of the "old" system. Only selected entries from the TIR are tabled. Should additional information be required to research and resolve each noted discrepancy, the original TIRs should be examined. As

Table 24

Potential Problems Encountered During the PIP Test with TPS and/or Operating System When Used with the Updated OQ-290(V)1 Electronic Equipment Test System

	TIR#	UUT Name	PN	SN	System Supported	UUT Program/ Date Compiled	Fault Inserted	PIP TestResult	Non-PIP Test Result
Problem occurred while connecting TPSs to support target control display (TCP)									
1.	NP-A0004		12306830	0049			None U2A -1	A10 card needs replacing	All cards need replacing
2.	NP-A0004	RE-RUN OF SAME UUT AS IMMEDIATELY ABOVE	12306830	0049			None	All tests GO	All cards need replacing
3.	NP-A0008	PCB, TACFIRE Logic No 16. DSKBD	587116-100	2187	TACFIRE	UUT Program 587116.IC 16 Feb 83	Open pin 14, U2A pin 6	LCA 094-BAD	Etch open between pin 14 and TP pin 9A, or short to adjacent lines.
4.	NP-A0009	PCB, TACFIRE Logic No 6. TLD BD	587106-102	5519	TACFIRE	UUT Program 587106.IC 20 Mar 83	Open pin 79 U6A -1	Open etch pin 12 to pin 28a	Etch open between pins 03 and TP pin 2a or etch short to adjacent lines.
5.	NP-A0010	PCB, TACFIRE Logic No 14. DO4 BD	587014-100	2084	TACFIRE	UUT Program 587014.IC 28 Mar 83	Open pin 68 U5A -1	Open etch between pin 2 to 16	Open etch between pin 68 and pin 33a
6.	NP-A0014	TACFIRE Logic No 12. DQ2 Board	587012-100	2062	TACFIRE	UUT Program 587012.IC 10 Feb 83	Masked pin 14, U2B-6	etch short between pin 40B and TP pin 21B	Etch open pin 14 and TP 9a
7.	NP-A0014	TACFIRE Logic No 12. DQ2 Board	587012-100	2062	TACFIRE	UUT Program 587012.IC 10 Feb 83	Masked pin 14, U2B-6	Open etch between pin 20B to TP pin 21B	Etch open between pins 33 and 16B or or etch short to adjacent lines.
8.	NP-A0015	PCB, TACFIRE Adder Decoder	587130-102	4627	TACFIRE	UUT Program 587130.IC 25 Mar 83	Open pin 20 U2-5	Open etch pin 65 TP 34B	Etch open between pins 20 and TP pin 11a
9.	NP-A0016	PCB, TACFIRE Logic No. 13, DT3 Board	5870133-100	3333	TACFIRE	UUT Program 587613.IC 10 Feb 83	Open pin A8, & SVDC	Open etch pin 16 to pin 32	CR-1 open check copper path associated with CR-1 for opens.
10.	NP-A0017	HEX S, DTL GATE ASSY	587011-100	2192	TACFIRE	UUT Program 587011.IC 01 Apr 83	Masked pin 2A, UIC-11	Open etch pin 32 to pin 44	Etch open between pins 01 and TP pin 2a or etch open to adjacent lines.
11.	NP-A0017	HEX S, DTL GATE ASSY	587011-100	2192	TACFIRE	UUT Program 587011.IC 01 Apr 83	Masked pin 2A, UIC-11	Check copper paths associated with U4 or defectives U4	Etch open between pins 01 and TP pin 2a or etch short to adjacent lines.
		RE-RUN OF SAME UUT AS IMMEDIATELY ABOVE					A RERUN OF SAME UUT AS IMMEDIATELY ABOVE		

noted earlier, there is no indication that the discrepancies reported represent a complete set--others may well exist. In a test such as this PIP Test it is likely that only a sample of problems will be detected. As the new system is used, careful attention should be given to the defects which the TPS report for the UUT tested and the extent to which those defects are validated by intermediate and depot level maintenance/repair activity. Results presented in Table 24 are intended only for use by systems/programming personnel in problem diagnosis and to facilitate any necessary correction.

SUMMARY AND CONCLUSIONS

Major findings reported herein are summarized by topical area.

Reading Grade Level (RGL)

Using the Fleisch-Kincaid procedure for computing RGL for several tasks (from several TMs), it was concluded in all cases that the RGL was below the maximum limit (grade 11) for the target audience (MOS 39B).

Equipment Publication Adequacy

While the three major publications used in the test facility were almost always rated as "mostly adequate" or better over seven rating areas, numerous specific recommendations for improvement were provided and recommended for inclusion in the next published version of the TMs.

Video Display Terminal (VDT)

Using eight rating areas, the keyboard and controls were almost always rated as "mostly adequate" or better. It was specifically recommended that a space bar be placed on the number pad and the PROCEED, YES and NO keys should be separated and/or color coded to reduce erroneous use.

Combined Tape/Control Station Indicator Lights

Using thirteen rating areas, all except one rating was "mostly adequate", or better. Some lights are a bit difficult to see from the standing position. At worst this is an inconvenience.

Combined Tape/Control Station Controls

Using sixteen rating areas, all ratings were "mostly adequate" or better.

Group Identification and Functional Labeling of Control Group

While the Combined Tape/Control Station was judged "completely adequate", three specific recommendations were made:

- Separation and/or color coding of PROCEED, YES, and NO keys.
- Design specific labels (imprinted on) function keys F1-F8 to circumvent problems that loss of the template would create.
- Add a terminal RESET key.

Weight Labeling of Operator Control Group Components

All components are adequately labeled.

Operation with/without Mission Oriented Protection Posture (MOPP) Gear

While few problems were noted while wearing MOPP gear, the time this gear was worn during the PIP was relatively short. Occassionality it was difficult to push individual keyboard keys when wearing MOPP gloves.

Sample Representativeness

Using ASVAB Composites and selected Subtests to compare target audience soldiers participating and not participating in the PIP indicated uniformly higher scores for those participating but statistically the difference could be attributed to chance. Comparison of participating and non-participating soldiers by education, rank, age and racial/ethnic distribution revealed no marked discrepancies.

Steady State Noise in the Test Facility

Test of noise level at six locations within the test facility indicated that the criterial level is exceeded throughout, but is especially a problem when the printer is operating. Since there are other problems associated with the printer, its replacement should be considered. There was no indication that the above-criterial noise levels interfered with operation of the test facility or caused any personal injury.

Health Hazards and System Safety

Table 25 presents an overall judgment of the importance of eleven identified potential hazards. Suggested corrective recommendations are also presented.

Computer Prompts and Operating Systems

Potential problem system implications are listed in Table 26.

Table 25

Importance of Identified Potential Hazards and Recommendations for Correction

Potential Hazard	Overall Importance	Suggested Recommendations
Electric Shock	There is a deficiency	Assign soldiers non-metallic tools and issue shoes which prevent grounding
Burns, Cuts, Abrasions	Improvements are recommended	Assume adequate medical attention is readily available
Extreme brightness or loudness, laser radiation and noxious fumes.	No problem noted	None
Falls	Improvements are recommended	1) Eliminate ledge that must be stepped over to enter the shelter 2) Provide a railing for the ladder 3) Add a riser to the ladder to reduce the distance between steps 4) Provide an exterior light 5) Provide a perimeter hand railing to the EETF roof
Lightning	No problem noted	Assure reliability of power protection unit
Damage to electronic equipment during transit	Improvements are recommended	Mount sensitive equipment on cushioned supports.

Table 26

Potential Computer Prompts and Operating System Problems and Implications

Potential Problem	Implication
1) Character set on new VDT appears to differ from old.	1) Output from some TPS may be distorted or unreadable.
2) Cursor control keys of new system operate only when test is not being executed.	2) Troubleshooting a problem is made more difficult.
3) Parts location will not printout until complete analysis is finished.	3) Parts location is needed in some tests to know where probes must be conducted.
4) TPS software yields different conclusions when using old and new equipment (11 occasions)	4) Operating system and/or computers prompts may lead to erroneous conclusions concerning UUT defects.

DATA REQUIRED BY THE PRIVACY ACT OF 1974
(5 U.S.C. 552a)

TITLE OF FORM	PRESCRIBING DIRECTIVE
Human Factors Questionnaire: Electronic Equipment Test Facility Operator (39B)	AR 70-1

1. AUTHORITY

10 USC Sec 4503

2. PRINCIPAL PURPOSE(S)

The data collected with the attached form are to be used for research purposes only.

3. ROUTINE USES

This is an experimental personnel data collection form developed by the U.S. Army Research Institute for the Behavioral and Social Sciences pursuant to its research mission as prescribed in AR 70-10. When identifier (name or Social Security Number) are requested they are to be used for administrative and statistical control purposes only. Full confidentiality of the responses will be maintained in the processing of these data.

4. MANDATORY OR VOLUNTARY DISCLOSURE AND EFFECT ON INDIVIDUAL NOT PROVIDING INFORMATION

Your participation in this research is strictly voluntary. Individuals are encouraged to provide complete and accurate information in the interests of the research, but there will be no effect on individuals for not providing all or any part of the information. This notice may be detached from the rest of the form and retained by the individual if so desired.

FORM - Privacy Act Statement - 26 Sep 75

DA Form 4368-R, 1 May 76 *(One-Time)*

APPENDIX B

HUMAN FACTORS QUESTIONNAIRE

ELECTRONIC EQUIPMENT TEST FACILITY OPERATOR (39B)

1. NAME_____ 2. DATE_____

The purpose of this interview is to obtain your opinions and observations about the adequacy of recent changes in the AN/MSM 105 Electronic Test Facility from your point of view.

3. Rank_____ 4. Age_____ 5. MOS_____

6. Skill Identifier_____ 7. Time in MOS_____

8. Years of Military Service_____ 9. Civilian Education (years)_____

10. Military Education (months)_____ 11. No. of Schools_____

12. Position in Unit_____

I. TRAINING/DOCUMENTATION MATERIALS: ORGANIZATION

Using the scale to the right, indicate with a check mark (✓) the adequacy of TM organization used to operate and maintain the EETF

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
10 Series	___	___	___	___	___
20 Series	___	___	___	___	___
30 Series	___	___	___	___	___

1) Explain BORDERLINE, MOSTLY INADEQUATE, or COMPLETELY INADEQUATE responses.
2) Indicate any problems you noted with organization of any of those TMs. Be specific.

II. TRAINING/DOCUMENTATION MATERIALS: COMPLETENESS

Using the scale to the right, indicate with a check mark (✓) the adequacy of TM completeness used to operate and maintain the EETF

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
10 Series	___	___	___	___	___
20 Series	___	___	___	___	___
30 Series	___	___	___	___	___

1) Explain BORDERLINE, MOSTLY INADEQUATE, or COMPLETELY INADEQUATE responses
2) Indicate any problems you noted with completeness of any of those TMs. Be specific.

III. TRAINING/DOCUMENTATION MATERIALS: ACCURACY

Using the scale to the right, indicate with a check mark (✓) the adequacy of TM <u>accuracy</u> used to <u>operate</u> and <u>maintain</u> the EETF

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
10 Series	____	____	____	____	____
20 Series	____	____	____	____	____
30 Series	____	____	____	____	____

1) Explain BORDERLINE, MOSTLY INADEQUATE, or COMPLETELY INADEQUATE responses
2) Indicate <u>any</u> problems you noted with <u>accuracy</u> of any of those TMs. Be specific.

IV. TRAINING/DOCUMENTATION MATERIALS: CLARITY

Using the scale to the right, indicate with a check mark (✓) the adequacy of TM clarity of expression used to operate and maintain the EETF

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
10 Series	___	___	___	___	___
20 Series	___	___	___	___	___
30 Series	___	___	___	___	___

1) Explain BORDERLINE, MOSTLY INADEQUATE, or COMPLETELY INADEQUATE responses
2) Indicate any problems you noted with clarity of expression of any of those TMs. Be specific.

V. TRAINING/DOCUMENTATION MATERIALS: INDEXING

Using the scale to the right, indicate with a check mark (✓) the adequacy of TM indexing and referencing used to operate and maintain the EETF

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
10 Series	___	___	___	___	___
20 Series	___	___	___	___	___
30 Series	___	___	___	___	___

1) Explain BORDERLINE, MOSTLY INADEQUATE, or COMPLETELY INADEQUATE responses.
2) Indicate any problems you noted with indexing and referencing of any of those TMs. Be specific.

VI. TRAINING/DOCUMENTATION MATERIALS: ILLUSTRATIONS

Using the scale to the right, indicate with a check mark (✓) the adequacy of TM illustrations clarity and usefulness used to operate and maintain the EETF	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
10 Series	___	___	___	___	___
20 Series	___	___	___	___	___
30 Series	___	___	___	___	___

1) Explain BORDERLINE, MOSTLY INADEQUATE, or COMPLETELY INADEQUATE responses.
2) Indicate any problems you noted with illustrations clarity and usefulness of any of those TMs. Be specific.

VII. TRAINING/DOCUMENTATION MATERIALS: DURABILITY

Using the scale to the right, indicate with a check mark (✓) the adequacy of TM durability for field use used to operate and maintain the EETF

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
10 Series	___	___	___	___	___
20 Series	___	___	___	___	___
30 Series	___	___	___	___	___

1) Explain BORDERLINE, MOSTLY INADEQUATE, or COMPLETELY INADEQUATE responses.
2) Indicate any problems you noted with durability for field use of any of those TMs. Be specific.

VIII. EQUIPMENT CHARACTERISTICS

A: VIDEO DISPLAY UNIT

Using the scale to the right, indicate with a check mark (✓) how adequate the Video Display Terminal is in each of the following areas:

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
1. DISPLAY					
a. Display brightness	___	___	___	___	___
b. Absence of glare	___	___	___	___	___
c. Absence of flicker	___	___	___	___	___
d. Letter discrimination	___	___	___	___	___
e. Viewing distance	___	___	___	___	___
f. Angle of view	___	___	___	___	___
g. Location of display	___	___	___	___	___
h. Adjustability (for visual access to test panel)	___	___	___	___	___
i. Other (specify)____ _____	___	___	___	___	___

2. KEYBOARD AND CONTROLS	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
a. Size	___	___	___	___	___
b. Shape	___	___	___	___	___
c. Spacing between controls	___	___	___	___	___
d. Resistance (too easy to turn or push, or too hard to turn or push) label	___	___	___	___	___
e. Label correctness					
f. Label visibility (size)	___	___	___	___	___
g. Label	___	___	___	___	___
h. Understandable labels	___	___	___	___	___
i. Location of labels	___	___	___	___	___
j. Absence of unrelated or confusing markings	___	___	___	___	___
k. Visibility of controls	___	___	___	___	___
l. Angle of view	___	___	___	___	___
m. Location of critical controls	___	___	___	___	___
n. Reach distance of critical controls	___	___	___	___	___
o. Location of noncritical controls	___	___	___	___	___
p. Reach distance of noncritical controls	___	___	___	___	___

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
q. Functional grouping (controls with related functions are grouped together)	___	___	___	___	___
r. Control type (type of control is appropriate for type of function)	___	___	___	___	___
s. Other (specify)___	___	___	___	___	___

3. Explain BORDERLINE, MOSTLY INADEQUATE or COMPLETELY INADEQUATE responses indicated in any of the above items. Be specific.

B: COMBINED TAPE/CONTROL STATION
(ECP 185 R1 CONFIGURATION).

Using the scale to the right, indicate with a check mark (✓) how adequate the Control Station is in each of the following areas:	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
1. INDICATOR LIGHTS					
a. Brightness	___	___	___	___	___
b. Absence of glare	___	___	___	___	___
c. Absence of flicker	___	___	___	___	___
d. Viewing distance	___	___	___	___	___
e. Angle of view	___	___	___	___	___
f. Understandable labels					
g. Correct labels	___	___	___	___	___
h. Label visibility (size)	___	___	___	___	___
i. Label completeness	___	___	___	___	___
j. Location of indicators	___	___	___	___	___
k. Indicator lights inform you of what you need to know					
(1) in a timely manner	___	___	___	___	___
(2) with enough precision	___	___	___	___	___
(3) with relevant information	___	___	___	___	___
i. Other (specify)____ _____	___	___	___	___	___

2. CONTROLS	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
a. Size	___	___	___	___	___
b. Shape	___	___	___	___	___
c. Spacing between controls	___	___	___	___	___
d. Resistance (too easy to turn or push, or too hard to turn or push)	___	___	___	___	___
e. Correct labels	___	___	___	___	___
f. Label completeness	___	___	___	___	___
g. Understandable labels	___	___	___	___	___
h. Label visibility (size)	___	___	___	___	___
i. Location of labels	___	___	___	___	___
j. Absence of unrelated or confusing markings	___	___	___	___	___
k. Visibility of controls	___	___	___	___	___
l. Angle of view	___	___	___	___	___
m. Location of critical controls	___	___	___	___	___
n. Reach distance of critical controls	___	___	___	___	___
o. Location of noncritical controls	___	___	___	___	___
p. Reach distance of noncritical controls	___	___	___	___	___
q. Functional grouping (controls with related functions are grouped together)	___	___	___	___	___

	Completely Adequate	Mostly Adequate	Borderline	Mostly Inadequate	Completely Inadequate
r. Control type (type of control is appropriate for type of function)	____	____	____	____	____
s. Other (specify)____	____	____	____	____	____

3. Explain of BORDERLINE, MOSTLY INADEQUATE, and COMPLETELY INADEQUATE responses indicated in any of the above items. Be specific.

IX. EVENT OCCURRENCE DURING TEST

A. POTENTIAL HAZARD	EXPERIENCED (Freq)	NEARLY EXPERIENCED	NEITHER EXPERIENCED/NOR NEARLY EXPERIENCED BUT IS A HAZARD
1. Electrical Shock (ES)	_____	_____	_____
2. Burns (B)	_____	_____	_____
3. Cuts or Abrasions (CA)	_____	_____	_____
4. Extreme Brightness (EB)	_____	_____	_____
5. Extreme Loudness (EL)	_____	_____	_____
6. Noxious Fumes (NF)	_____	_____	_____
7. Falls (F)	_____	_____	_____
8. Laser Radiation (LR)	_____	_____	_____

B. DETAILS OF SPECIFIC EVENTS

(Type, specific cause, anaticipated, design change needed)

X. EVENT LIKLIHOOD OF OCCURRENCE

Based on your knowledge of EETF tasks, how likel;y do you believe this event (SEE LIST) will occur? (HAZARD FREQUENCY)

	Will be continuously experienced	Will occur frequency	Will occur several times	Unlikely but possible	Extremely improbable	Physically impossible
1. Electrical Shock (ES)	_____	_____	_____	_____	_____	_____
2. Burns (B)	_____	_____	_____	_____	_____	_____
3. Cuts or Abrasions (CA)	_____	_____	_____	_____	_____	_____
4. Extreme Brightness (EB)	_____	_____	_____	_____	_____	_____
5. Extreme Loudness (EL)	_____	_____	_____	_____	_____	_____
6. Noxious Fumes (NF)	_____	_____	_____	_____	_____	_____
7. Falls (F)	_____	_____	_____	_____	_____	_____
8. Laser Radiation (LR)	_____	_____	_____	_____	_____	_____

XI. EVENT SEVERITY (WHEN OCCURS)

Based on your knowledge of EETF tasks, how severe do you believe this event in the EETF (SEE LIST) would be to your health? (HAZARD SEVERITY--HEALTH)

	May cause death	May cause severe injury or illness	May cause minor injury or illness	Will not result in injury or illness
1. Electrical Shock (ES)	_____	_____	_____	_____
2. Burns (B)	_____	_____	_____	_____
3. Cuts or Abrasions (CA)	_____	_____	_____	_____
4. Extreme Brightness (EB)	_____	_____	_____	_____
5. Extreme Loudness (EL)	_____	_____	_____	_____
6. Noxious Fumes (NF)	_____	_____	_____	_____
7. Falls (F)	_____	_____	_____	_____
8. Laser Radiation (LR)	_____	_____	_____	_____

APPENDIX C

LIST OF MAJOR ACRONYMS USED

AFQT	Armed Forces Qualification Test
AR	Arithmetic Reasoning Subtest
ARI	Army Research Institute
ASVAB	Armed Services Vocational Aptitude Battery
ATE	Automatic Test Equipment
CEBD	Communications Electronic Board
CL	Clerical Composite
CO	Combat Composite
dB	Decibel
DTOS	Diagnostic Tape Operating System
EAC	Echelons Above Corps
EETF	Electronics Equipment Test Facility
EI	Electronics Informations Subtest
EL	Electronics Composite
ERF	Electronic Repair Facility
ETF	Electronic Test Facility
FA	Field Artillery Composite
GM	General Mechanical Composite
GS	General Science Subtest
GT	General Technical Composite
IGS	Intermediate General Support
LRU	Line Replacement Unit
MANPRINT	Manpower and Personnel Integration
MC	Mechanical Comprehension Subtest
MK	Mathematics Knowledge Subtest
MM	Motor Maintenance Composite
MOPP	Mission Oriented Protective Posture
MOS	Military Occupational Specialty
NO	Numerical Operations Subtest
O&O	Operational and Organizational
OF	Operators/Food Composite
PCB	Printed Circuit Board
PIP	Product Improvement Program
PIU	Program Interface Unit
PMCS	Preventive Maintenance Checks and Services
RF	Radio Frequency
RGL	Reading Grade Level
SC	Surveillance/Communications Composite
SD	Standard Deviation
SQT	Skill Qualification Test
ST	Skilled Technical Composite
TCC	Tactical Communications Control
TIR	Test Incident Report
TM	Technical Manual
TPS	Test Program Set
UUT	Unit Under Test
VDT	Video Display Terminal
VTOCP	Virtual Test Operator's Control Panel
WK	Word Knowledge Subtest